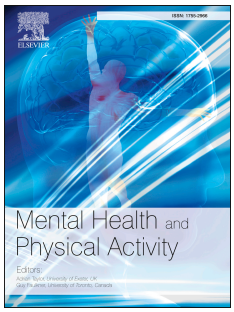
DOI:
10.1016/j.mhpa.2017.05.002

Document Version
Peer reviewed version

Accepted Manuscript



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PII: S1755-2966(17)30017-0

DOI: 10.1016/j.mhpa.2017.05.002

Reference: MHPA 215

To appear in: *Mental Health and Physical Activity*

Received Date: 18 February 2017

Revised Date: 5 April 2017

Accepted Date: 5 May 2017

Please cite this article as: Vancampfort, D., Stubbs, B., Hallgren, M., Koyanagi, A., Physical activity correlates in heavy episodic drinkers: Data from 46 low- and middle-income countries, *Mental Health and Physical Activity* (2017), doi: 10.1016/j.mhpa.2017.05.002.

SPECIAL ISSUE MENPA

Physical activity correlates in heavy episodic drinkers: data from 46 low- and middle-income countries

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Running title: physical activity correlates in hazardous drinkers

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Abstract

Objective: To investigate physical activity (PA) correlates among community-dwelling adults with frequent (i.e., at least twice per week), heavy episodic drinking habits (4 drinks for women and 5 for men) in 46 low- and middle-income countries.

Method: Cross-sectional data from the World Health Survey were analyzed. PA was assessed by the International Physical Activity Questionnaire and participants were dichotomized into those who meet (≥150 minutes moderate-vigorous PA) or do not meet (<150 minutes) recommended PA weekly targets. Multivariable logistic regression was used to assess the correlates.

Results: The analysis included 4186 frequent heavy episodic drinkers (39.4±13.9years; 78.7% males). The prevalence of low PA was 24.4% (95%CI=23.2%-25.8%). Older age [odds ratio (OR)=1.02 per one-year increase], not married/cohabiting (vs. married/cohabiting OR=1.31), higher (tertiary) education (vs. no formal OR=1.67), being in the richest quintile (vs. poorest OR=1.58), unemployed (vs. employed OR=1.86), urban setting (vs. rural OR=1.69) and mobility difficulties (OR=1.07, per unit increase in a scale ranging from 0-10) were all significant correlates of low PA.

Conclusions: PA is associated with a range of factors among people with frequent heavy episodic drinking habits. The identified correlates provide clues as to how PA may be increased in this vulnerable population. Future research should explore the role of specific environmental attributes relevant to PA on mental health populations (and people with alcohol use problems) in low- and middle-income countries.

Key words: alcohol; physical activity; mental health; exercise; health

Introduction

Alcohol use disorders are among the most common and undertreated mental disorders with an estimated global lifetime prevalence of around 16% (Connor, Haber, & Hall, 2016). Globally, harmful use of alcohol causes approximately 3.3 million deaths every year (or 5.9% of all deaths), and 5.1% of the global burden of disease is attributable to alcohol consumption (WHO, 2014). Excessive use of alcohol is linked to more than 60 different chronic diseases (Connor, et al., 2016). The major causes of premature death to which it contributes are injury, alcoholic liver disease, cancers, gastrointestinal and heart diseases and stroke (Roerecke & Rehm, 2014). Beyond health consequences, alcohol use inflicts significant social and economic losses on individuals and society at large (Room, Babor, & Rehm, 2005; Skog, 2006).

Heavy Episodic Drinking (HED) - also referred to as 'binge' drinking - is defined by the World Health Organization (2002) as the consumption of 60 grams or more alcohol (40+ grams for women) on a single occasion. A marginally lower threshold has been proposed by the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2017). Formerly labelled 'high risk' drinking (World Health Organization, 2002), HED is now recognized as a major public health issue in many countries as it is consistently associated with a range of serious acute harms, including accidents, violence and anti-social behaviors (Navarro, Doran, & Shakeshaft, 2011; Rehm, et al., 2009). Indications of regular or frequent HED are especially concerning, as this may lead to both acute and chronic alcohol-related harms or the development of an alcohol use disorder (Rehm, et al., 2009).

Current treatment options for people with alcohol use problems include pharmacotherapy, cognitive behavioral therapy, behavioral therapies based on conditioning, motivational enhancement therapy and 12-step facilitation (mutual peer support) (Connor, et al., 2016). Despite advancements in these treatment modalities, relapse remains high with many individuals relapsing into the dependency syndrome following a period of abstinence. Pharmacotherapy has unwanted side-effects and compliance is often low (Reid, Teesson, Sannibale, Matsuda, & Haber, 2005). After formal treatment, meta-analyses find abstinence rates ranging from 25% (Miller, Walters, & Bennett, 2001) to 43% (Monahan & Finney, 1996) dependent on treatment intensity and length of follow-up. Considering these issues, there is a high need for novel adjunctive interventions that may help in alcohol abstinence. There is also a strong need to treat the co-morbid health problems associated with the disorder, which include higher prevalence of diabetes and cardiovascular disease (Vancampfort, Hallgren, et al., 2016; Vancampfort, Mugisha, et al., 2016).

Although the association between physical activity and alcohol consumption is complex, with many studies also reporting a positive association between these variables (Dodge, Clarke, & Dwan, 2016), available evidence suggests that planned exercise interventions in people with alcohol use disorders can have important health benefits. In a recent meta-analysis including 24 studies and 1,204 unique persons

with alcohol use disorders (mean age 37.8 years, mean illness duration 4.4 years) (Hallgren, Vancampfort, Giesen, Lundin, & Stubbs, 2017), it was demonstrated that although exercise did not reduce daily (standard mean difference, SMD =-0.886, p=0.24) or weekly (SMD=-0.353, p=0.21) standard drinking days, nor Alcohol Use Disorders Identification Test (AUDIT) scores (SMD=-0.378, p=0.18), exercise significantly reduced depressive symptoms (SMD=-0.867, p=0.006), and improved physical fitness (SMD=0.564, p=0.01) versus control conditions. Of clinical importance was that the pooled dropout rate in this meta-analysis was very high: 40.3% (95% CI=23.3 to 60.1). As a comparison, in a recent meta-analysis of dropouts from physical activity interventions in schizophrenia (N=19 studies, 594 participants) (Vancampfort, Rosenbaum, et al., 2016), the pooled dropout rate was 26.7%, while in another meta-analysis among people with depression (N= 40 studies, 1720 participants) (Brendon Stubbs, et al., 2016), an adjusted dropout rate of 18.1% was reported. Therefore, one of the most important challenges for health care professionals and researchers is to improve the adherence towards and reduce the dropout from physical activity interventions in people with alcohol use disorders. In a previous systematic review (Vancampfort, et al., 2015), functional impairments and distress associated with alcohol use disorders including increased smoking rates, obesity, anxiety, depression and a lower self-efficacy were identified as possible barriers.

Given the important health benefits of physical activity and the high dropout of people with alcohol problems in physical activity interventions, there is a need for research to investigate at a population and multinational level what factors influence physical activity participation in people who drink at risky levels and who do not comply with the international recommendation of 150 min of moderate to vigorous or 75 min of vigorous physical activity per week. To date, such data are currently lacking, and no studies have focused specifically on heavy episodic drinkers Data on physical activity correlates in this population in low- and middle-income countries (LMICs) is even more scarce. Exploring socio-demographic, mental and physical health related correlates in LMICs is important given the suboptimal treatment of alcohol abuse (Patel, et al., 2007), differences in knowledge regarding the benefits of physical activity (Pengpid, et al., 2015), and different environmental factors (Atkinson, Lowe, & Moore, 2016) in LMICs. The lack of studies from LMICs also highlights the gap between where the majority of research is done and where the largest public health impacts of physical inactivity are found (Sallis, Bull, et al., 2016). Information on physical activity correlates in HED in LMICS could guide the design and delivery of targeted interventions. Thus, given the aforementioned gaps within the literature, we aimed to assess physical activity correlates among community-dwelling adults with indications of frequent heavy episodic drinking in 46 LMICs.

Methods

Settings and protocol

Secondary data analysis of the World Health Survey (WHS) (2002-2004) (http://www.who.int/healthinfo/survey/en/) was done. The WHS is a cross-sectional study implemented in 70 countries worldwide. Single-stage random sampling and stratified multi-stage random cluster sampling were conducted in 10 and 60 countries respectively. All individuals aged ≥18 years with a valid home address were eligible to participate. Each eligible member of the household had equal probability of being selected with the use of Kish tables. The survey did not cover populations on military reservations, in group quarters or in living arrangements other than private households. Standardized questionnaires were used to collect information in all countries. Standard translation procedures ensured comparability between countries. Face-to-face or telephone interviews were carried out by trained interviewers. The individual response rate across all countries was 98.5% (Nuevo, et al., 2012). Ethical approval was obtained from ethical boards at each study center. All participants provided informed consent.

Variables

Alcohol consumption

The question 'Have you ever consumed a drink that contains alcohol (such as beer, wine, etc.)?' with 'yes' and 'no' answer options was used to identify lifetime abstainers. Those who replied affirmatively were then asked the next question on the number of standard drinks of any alcoholic beverage the respondent had on each day of the past 7 days. A showcard with pictures was used to illustrate what was meant by a "standard drink", and defined by WHS as containing between 8-13 g of ethanol depending on the country. The number of days in the past week in which 4 (female) or 5 (male) drinks were consumed was calculated (World Health Organization, 2002). Frequent, heavy episodic drinkers were defined as those who consumed the above amount of alcohol on two or more days of the past 7 days.

Physical activity

Items from the International Physical Activity Questionnaire (Craig, et al., 2003) were used to categorize physical activity. Specifically, participants were asked how many days over the past week on average they engaged in moderate physical activity and in vigorous physical activity. Secondly, participants were asked for how many minutes on average, they engage in physical activity at a moderate and vigorous level. The total amount of moderate to vigorous physical activity over the last week was calculated and those scoring

≥150 minutes for moderate to vigorous physical activity or ≥75 minutes for vigorous physical activity alone were classified as meeting the recommended guidelines (coded 0), and those scoring <150 minutes for moderate to vigorous physical activity and <75 minutes for vigorous physical activity alone (low physical activity) were classified as not meeting the recommended guidelines (coded 1).

Sociodemographic factors

These included information on gender, age, marital status [Married/cohabiting or other (never married/separated/divorced/widowed)], highest education attained (no formal, primary, secondary completed, tertiary completed), wealth quintiles, employment status (unemployed or not), and setting (rural or urban). Principal component analysis based on 15-20 assets was performed to establish country-wise wealth quintiles. Employment status was assessed with the question 'What is your current job?'. Those who answered 'not working for pay' were considered to be unemployed.

Health behaviors

Current smoking was assessed with the question 'Do you currently smoke any tobacco products such as cigarettes, cigars, or pipes?' The answer options to this question were 'daily', 'yes, but not daily', or 'no, not at all'. Two separate questions for fruits and vegetables were used to assess the amount of servings the participant eats on a typical day. The answer to these questions were dichotomized as <5 or ≥5 servings/day following WHO/FAO recommendations (Bishwajit, et al., 2017).

Mental health

Depression was based on the DSM-IV algorithm and used information on duration and persistence of depressive symptoms in the past 12 months (Cifuentes, et al., 2008; Loerbroks, Herr, Subramanian, & Bosch, 2012). The question 'Overall in the past 30 days, how much of a problem did you have with worry or anxiety' was used to assess anxiety. This question had the following answer options: 'none', 'mild', 'moderate', 'severe', and 'extreme'. In accordance with previous WHS publications, those who answered 'severe' and 'extreme' were considered to have anxiety (Koyanagi & Stickley, 2015; Vancampfort, Koyanagi, Hallgren, Probst, & Stubbs, 2017; Wong, Hunter Rowe, Douwes, & Senthilselvan, 2013). Details for the variables on sleep/energy and cognition are provided below (section on health status).

Physical health

Having extreme difficulty in seeing and recognizing a person that the participant knows across the road (i.e., from a distance about 20 meters) (Freeman, et al., 2013) was used as the definition of visual

impairment. A previous study showed that this condition likely corresponds to World Health Organization definitions of visual impairment (Freeman, et al., 2013). The presence of hearing problems was based on interviewer's observation of this condition at the conclusion of the survey. Arthritis, asthma, and diabetes were based on self-reported lifetime diagnosis. For angina, in addition to a self-reported diagnosis, a symptom-based diagnosis based on the Rose questionnaire was also used (Rose, 1962). Details on the variables on pain/discomfort and mobility difficulty are provided in the section below (health status).

Health status variables

Eight questions pertaining to four domains (i.e., sleep/energy, cognition, pain/discomfort, mobility) were used to assess health status. These domains are comparable to those often used in health-related quality of life outcome measures such as the Short Form-12 (SF-12) (Ware, Kosinski, & Keller, 1996), the Health Utilities Index Mark-3 (HUI) (Feeny, Furlong, Boyle, & Torrance, 1995), and the EUROQOL-5D (Kind, 1996). Each domain consists of two questions on the health status during the past 30 days. The actual questions can be found in eTable 1 (Appendix). The answer option for each question was based on a five-point scale ranging from 'none' to 'extreme/cannot do'. For each separate domain, we used factor analysis with polychoric correlations to estimate a factor score which was later converted to scores ranging from 0-10 with higher values corresponding to worse health function (B. Stubbs, A. Koyanagi, F. Schuch, et al., 2016; B. Stubbs, A. Koyanagi, F. B. Schuch, et al., 2016).

Statistical analyses

Data from 69 countries were publicly available. Of these countries, 18 high-income countries were excluded as the focus of the study was on LMICs. Of the remaining LMICs, Morocco and Latvia were not included as they lacked information on physical activity, and Turkey and Slovenia were also excluded due to lack of several variables pertaining to the analysis. Furthermore, Mauritania was excluded as there were no frequent heavy drinkers. Thus, a total of 46 countries, which were all LMICs according to the World Bank classification in 2003, were included in the analysis. The current analysis was restricted to frequent heavy episodic drinkers as the aim of the study was to assess the correlates of physical activity in this population. The final analytical sample consisted of frequent heavy episodic drinkers who provided information on physical activity (n=4186) (Appendix eTable 2).

The statistical analysis was performed with Stata 14.1 (Stata Corp LP, College station, Texas). A total of 22 potential correlates of physical activity were assessed. The selection of these correlates was based on past literature (Sallis, et al., 2006; Sallis, Owen, & Fisher, 2008). In order to assess the correlates of low physical activity, we conducted random effects logistic regression of a two-level structure in which

individuals were level one and country was level two. This analytical method allowed for the adjustment for clustering within country. First, we assessed the sociodemographic correlates. For subsequent models, the correlates pertaining to health behavior, and mental and physical health were included individually in the models while adjusting for the sociodemographic correlates (sex, age, education, marital status, wealth, employment, setting).

For all regression analyses, the variables were included in the models as categorical variables with the exception of age, sleep/energy, cognition, pain/discomfort, and mobility (continuous variables). Results from the logistic regression models are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at $P<0.05$.

Results

The prevalence of low physical activity was 24.4% (95%CI=23.2%-25.8%) in this sample of frequent heavy episodic drinkers (n=4186). The mean (SD) age was 39.4 (13.9) years and 78.7% of the sample were males. The sample characteristics are provided in **Table 1**.

Insert Table 1 about here

Female sex, not being married or cohabiting, higher levels of education and wealth, unemployment, urban setting, poor sleep/energy, hearing problems, diabetes, pain/discomfort, and mobility difficulty were associated with low physical activity based on the unadjusted analysis. The results of the association between sociodemographic factors and low physical activity estimated by multivariable logistic regression are illustrated in **Table 2**. Age (per one-unit increase: OR=1.02; 95%CI=1.02-1.02), not being married or cohabiting (vs. married/cohabiting: OR=1.31; 95%CI=1.09-1.56), higher education (e.g., tertiary vs. no formal: OR=1.67; 95%CI=1.10-2.53), highest wealth quintile (vs. lowest: OR=1.58; 95%CI=1.19-2.10), being unemployed (vs. employed: OR 1.86; 95%CI=1.53-2.25), and urban setting (vs. rural: OR=1.69; 95%CI=1.39-2.08) were associated with higher odds for low physical activity. Sex was not a significant correlate of low physical activity.

Insert Table 2 about here

Table 3 shows the association between health behaviors, mental and physical health factors based on multivariable logistic regression analysis. There were no significant correlates in the domains of health behavior and mental health. For the physical health domain, only mobility difficulties were associated with increased odds for low physical activity.

Insert Table 3 about here

Discussion

To the best of our knowledge, the current multi-national study is the first to explore physical activity correlates in frequent (i.e., at least twice per week), heavy episodic drinkers (4 drinks for women and 5 for men). We found that across 4186 people with these consumption patterns, older age (OR=1.02 per one-year increase), not married/cohabiting (vs. married/cohabiting OR=1.31), higher (tertiary) education (vs. no formal OR=1.67), being in the richest quintile (vs. poorest OR=1.58), unemployed (vs. employed OR=1.86), urban setting (vs. rural OR=1.69) and mobility difficulties (OR=1.07, per unit increase) were all significant correlates of low PA.

The observation that older age and the presence of mobility problems were associated with less physical activity is consistent with data from the general population (O'Donoghue, et al., 2016; Trost, Owen, Bauman, Sallis, & Brown, 2002) and people with depression (Krogh, Lorentzen, Subhi, & Nordentoft, 2014). Disturbed gait and balance are well-documented sequelae of aging and of chronic alcoholism and may result from damage to one or more neural systems (Sullivan, Rosenbloom, Lim, & Pfefferbaum, 2000). Alcohol is also known to be an effective analgesic and influences people's perception of pain (Thompson, Oram, Correll, Tsermentseli, & Stubbs, 2016). Given that people who drink at risky levels are at increased risk of various painful comorbidities (Bell & Britton, 2014; Vancampfort, Mugisha, et al., 2016), it might be postulated that drinking might enable people to not feel painful conditions which may impair mobility (e.g. diabetic complications/ neuropathy), but it could negatively influence their mobility and alter their independence. Thus, collaborative interventions that seek to improve mobility among those with alcohol use problems might be an important strategy to increase physical activity in this population.

Our data also suggest that socioeconomic variables should be taken into consideration in future research or when planning interventions. One of the most consistent findings in the literature on alcohol use is that patterns of consumption vary by marital status, with heavier drinking levels among divorced or single people than among those who are married (Power, Rodgers, & Hope, 1999). In our study, not being married/cohabiting was also associated with being less physically active. While the mechanism linking marital status with low physical activity is not clear, it may be that those who are not married or not cohabiting tend to feel lonelier, and this may in turn lead to less physical activity. Indeed, loneliness has been linked with alcohol abuse (Åkerlind & Hörnquist, 1992) and lower physical activity in the general population (Hawkley, Thisted, & Cacioppo, 2009). Also those who were unemployed are less physically active. A recent cross-sectional study involving workers from the USA and Sweden found that among the employed, occupational physical activity is associated with higher total physical activity and less sedentary

time for both genders (Kwak, Berrigan, Van Domelen, Sjöström, & Hagströmer, 2016). It might also be speculated that employment enhances social connectedness, and social support has been linked prospectively to greater engagement in leisure time physical activity (Oliveira, et al., 2011). Thus, future research exploring the extent to which social support can increase physical activity in this population is warranted. In particular, the amount and type of social support necessary to initiate and maintain a physically active lifestyle in this vulnerable and often stigmatized population (Van Boekel, Brouwers, Van Weeghel, & Garretsen, 2013) should be investigated, especially in settings with limited resources.

In contrast to high-income countries, where those of a higher socioeconomic position are generally known to be more physically active during leisure time (Beenackers, et al., 2012), our data in LMICs show that those in the richest wealth quintile and those with a higher education are less physically active. Potential explanations for this include more use of motorized transport, more sedentary screen-based leisure and less labor-demanding jobs among the richest and higher educated people in LMICs. Higher educated and wealthier people in LMICs live and work more in urban environments. Our study showed that people living in urban environments are indeed less physically active. Differences between rural and urban settings might also be related to the fact that an urban environment in most LMICs is not conducive to safe physical activity due to unsafe traffic, increased risk of crime and fear of crime (De Bourdeaudhuij, et al., 2015), which are, in turn, linked to stress and depression (Smit, et al., 2016) and which might consequently be risk factors for more alcohol use as well.

The observation that depression was not associated with low physical activity participation might be due to the different time frames used. While the IPAQ captures physical activity over the past 7 days, the presence of depression was assessed over a 12 months period.

Practical implications, limitations and future research

Previous research indicates that physical activity interventions are feasible in those with alcohol use disorders, and may have positive effects on physical fitness and depression (Hallgren, et al., 2017). A positive trend on consumption was also reported in one recent review (Giesen, Deimel, & Bloch, 2015). The current findings suggest a need to tailor physical activity interventions to different age groups, and to consider how mobility problems might affect the engagement and maintenance of exercise programs. Although it is unclear from previous research whether physical activity or alcohol use is driving the positive relationship between these two variables (Dodge, et al., 2016), it may be useful to actively counsel people with alcohol problems on the health benefits of physical activity and exercise. Several limitations are acknowledged; our study is cross-sectional; consequently, cause and effect cannot be deduced from the observed associations. Thus, future prospective research is required to disentangle the directionality of the

observed relationships. Another issue is that although we followed the recommendations of the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2017) for defining HED (i.e., 4 drinks for women and 5 for men),we applied an additional threshold of twice per week to identify 'frequent' HED. This threshold implies regularity or a pattern of drinking, which in reality may not exist beyond the week in which alcohol consumption was rated. Thus, it is possible that some participants were misclassified as 'frequent' heavy episodic drinkers. Moreover, although frequent HED increases the risk of developing an alcohol use disorder, and may be considered 'problematic' in itself, we were not able to confirm whether or not the participants had an alcohol use disorder based on established diagnostic criteria. Therefore, future studies should include a more complete alcohol use disorder assessment and ideally use a clinical diagnosis. The number of current drinkers in the WHS, and the amount of drinking are likely underestimates as well. Stigma, religious beliefs, social norms and gender roles may contribute to the underreporting of alcohol use in LMICs (Consumption, 2007). Third, our sample included a relatively low prevalence of insufficiently active adults of 24% when compared to previous global calculations of 31% (Hallal, et al., 2012). However, this is explained by the use of the IPAQ measurement tool for our data, which is known to over-report physical activity participation (Stubbs, et al., 2017). Fourth, the current study only included non-institutionalized people and therefore, the data cannot be generalized to the institutionalized who are more likely to be inactive. Fifth, we were not able to explore differences in physical activity behavior in people with alcohol use problems living in urban versus rural settings in more detail. For example, future research should explore the role of specific environmental attributes relevant to physical activity on mental health populations (including alcohol use disorders) in LMICs such as the availability and quality of sidewalks, pedestrian zones, bicycle facilities, and factors affecting intersection quality (e.g., crosswalks, pedestrian signals). Also prospective studies and quasi-experimental evaluations of improvements in urban environments on the mental and physical health of people with mental problems in LMICs are urgently needed. Next to this, physical activity supportive environments should become a vital component of a mental and physical health policy. Design of physical activity stimulating urban environments has the potential to contribute nearly 90 min/week of physical activity, which is 60% of the 150 min/week recommended in physical activity guidelines (Sallis, Cerin, et al., 2016). Finally, future studies in LMICs may wish to assess how macro-level environmental factors (e.g., food insecurity, civil conflicts, extreme weather conditions) are linked to physical inactivity in this part of the world.

In conclusion, our data illustrate that a number of socioeconomic and health factors are associated with physical activity levels among people with alcohol problems from 46 LMICs. These findings provide guidance for future population level interventions across LMICs to help people with alcohol problems to become more active.

Acknowledgements

None

Conflicts of interest

None

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Table 1 Sample characteristics (overall and by low physical activity) of frequent heavy episodic drinkers

			Low physical activity[a]		
Characteristic	Category	Total	No	Yes	P-value[b]
Sociodemographic factors					
Sex	Male	78.7	79.9	75.2	0.001
Age (years)	Mean (SD)	39.4 (13.9)	39.0 (13.3)	40.6 (15.6)	0.001
Marital status	Married/cohabiting	64.7	67.8	55.0	<0.001
Education	No formal	20.5	22.2	15.2	<0.001
	Primary	38.2	38.0	38.9	
	Secondary completed	31.8	30.9	34.3	
	Tertiary completed	9.6	8.9	11.6	
Wealth	Poorest	23.0	24.5	18.5	<0.001
	Poorer	21.4	21.7	20.5	
	Middle	18.9	19.1	18.2	
	Richer	18.1	18.3	17.4	
	Richest	18.6	16.5	25.4	
Unemployed	Yes	25.5	22.7	34.4	<0.001
Setting	Urban	47.5	42.4	63.1	<0.001
Health behavior					
Current smoking	No	44.6	44.1	45.9	0.438
	Non-daily	10.4	10.3	10.8	
	Daily	45.1	45.6	43.3	
Fruit consumption[c]	<5 servings/day	89.1	89.0	89.4	0.725
Vegetable consumption[c]	<5 servings/day	94.4	94.1	95.3	0.194
Mental health					
Depression	Yes	5.7	5.5	6.4	0.318
Anxiety	Yes	10.5	10.0	12.0	0.074
Sleep/energy[d]	Mean (SD)	2.1 (2.6)	2.0 (2.5)	2.3 (2.7)	0.009
Cognition[d]	Mean (SD)	1.7 (2.5)	1.7 (2.5)	1.8 (2.6)	0.278
Physical health					
Visual impairment	Yes	0.6	0.6	0.6	0.860
Hearing problem	Yes	2.9	2.6	3.9	0.030
Arthritis	Yes	11.4	11.5	11.0	0.669
Angina	Yes	13.6	13.9	12.7	0.341
Asthma	Yes	4.0	4.1	3.7	0.552
Diabetes	Yes	2.0	1.5	3.3	<0.001
Pain/discomfort[d]	Mean (SD)	2.2 (2.6)	2.2 (2.5)	2.4 (2.7)	0.011
Mobility[d]	Mean (SD)	1.8 (2.5)	1.7 (2.4)	2.1 (2.8)	<0.001

Abbreviation: SD Standard deviation

Data are column % unless otherwise stated.

[a] The total amount of moderate to vigorous physical activity over the last week was calculated and those scoring <150 minutes were considered to have low physical activity.

[b] P-values for the difference in sample characteristics by physical activity level were obtained with Student's *t*-tests (continuous variables) and Chi-squared tests (categorical variables).

[c] Mexico is not included as data on fruit and vegetable consumption were not collected.

[d] These variables had scores ranging from 0 to 10 (higher scores indicating worse conditions).

Table 2 Association between sociodemographic factors and low physical activity among frequent heavy episodic drinkers estimated by multivariable logistic regression

Characteristic	Category	OR	95%CI	P-value
Sex	Female	1.00		
	Male	0.92	[0.75,1.13]	0.402
Age (years)[a]	per one year increase	1.02***	[1.02,1.03]	<0.001
Marital status	Married/cohabiting	1.00		
	Other	1.31**	[1.09,1.56]	0.003
Education	No formal	1.00		
	Primary	1.26	[0.94,1.69]	0.119
	Secondary completed	1.51*	[1.07,2.12]	0.019
	Tertiary completed	1.67*	[1.10,2.53]	0.015
Wealth	Poorest	1.00		
	Poorer	1.14	[0.88,1.47]	0.313
	Middle	1.21	[0.93,1.58]	0.150
	Richer	1.08	[0.82,1.43]	0.578
	Richest	1.58**	[1.19,2.10]	0.002
Unemployed	No	1.00		
	Yes	1.86***	[1.53,2.25]	<0.001
Setting	Rural	1.00		
	Urban	1.69***	[1.39,2.06]	<0.001

Abbreviation: OR Odds Ratio; CI Confidence Interval
The total amount of moderate to vigorous physical activity over the last week was calculated and those scoring <150 minutes were considered to have low physical activity.
Model is adjusted for all covariates in the Table and clustering within country.
[a] Included in the model as a continuous variable.
* p<0.05, ** p<0.01, *** p<0.001

Table 3 Association of health behaviors, mental and physical health factors with low physical activity among frequent heavy episodic drinkers estimated by multivariable logistic regression

Characteristic	Category	OR	95%CI	P-value
Health behavior				
Current smoking	No	1.00		
	Non-daily	1.13	[0.85,1.49]	0.405
	Daily	1.13	[0.94,1.35]	0.195
Fruit consumption[a]	≥5	1.00		
(servings/day)	<5	0.99	[0.74,1.31]	0.920
Vegetable consumption[a]	≥5	1.00		
(servings/day)	<5	1.15	[0.77,1.72]	0.499
Mental health				
Depression	No	1.00		
	Yes	0.92	[0.65,1.31]	0.655
Anxiety	No	1.00		
	Yes	1.20	[0.92,1.57]	0.188
Sleep/energy[b]	per unit increase	1.02	[0.99,1.05]	0.291
Cognition[b]	per unit increase	1.02	[0.98,1.05]	0.311
Physical health				
Visual impairment	No	1.00		
	Yes	1.26	[0.45,3.52]	0.656
Hearing problem	No	1.00		
	Yes	1.58	[0.99,2.52]	0.056
Arthritis	No	1.00		
	Yes	0.97	[0.73,1.27]	0.803
Angina	No	1.00		
	Yes	0.92	[0.71,1.18]	0.492
Asthma	No	1.00		
	Yes	0.68	[0.45,1.04]	0.077
Diabetes	No	1.00		
	Yes	1.06	[0.60,1.88]	0.847
Pain/discomfort[b]	per unit increase	1.02	[0.99,1.05]	0.286
Mobility[b]	per unit increase	1.07***	[1.03,1.11]	<0.001

Abbreviation: OR Odds Ratio; CI Confidence Interval

The total amount of moderate to vigorous physical activity over the last week was calculated and those scoring <150 minutes were considered to have low physical activity.

Each variable in the Table was included in separate models adjusting for sex, age, education, marital status, wealth, employment, setting, and clustering within country.

[a] Mexico is not included as data on fruit and vegetable consumption were not collected.

[b] These variables had scores ranging from 0 to 10 (higher scores indicating worse conditions) and were included in the models as continuous variables.

*** p<0.001

eTable 1 Questions used to assess health status

Mobility	(1) Overall in the last 30 days, how much difficulty did you have with moving around? (2) In the last 30 days, how much difficulty did you have in vigorous activities, such as running 3 km (or equivalent) or cycling?
Pain/ discomfort	(1) Overall in the last 30 days, how much of bodily aches or pains did you have? (2) In the last 30 days, how much bodily discomfort did you have?
Cognition	(1) Overall in the last 30 days, how much difficulty did you have with concentrating or remembering things? (2) In the last 30 days, how much difficulty did you have in learning a new task (for example, learning how to get to a new place, learning a new game, learning a new recipe etc.)?
Sleep/energy	(1) Overall in the last 30 days, how much of a problem did you have with sleeping, such as falling asleep, waking up frequently during the night or waking up too early in the morning? (2) In the last 30 days, how much of a problem did you have due to not feeling rested and refreshed during the day (e.g., feeling tired, not having energy)?

eTable 2 Number of frequent heavy episodic drinkers by country

Country	N	Country	N
Bangladesh	9	Malaysia	14
Bosnia and Herzegovina	5	Mali	4
Brazil	216	Mauritius	71
Burkina Faso	394	Mexico	212
Chad	314	Myanmar	42
China	120	Namibia	145
Comoros	1	Nepal	88
Croatia	22	Pakistan	3
Czech Republic	61	Paraguay	301
Dominican Republic	131	Philippines	216
Ecuador	17	Republic of Congo	31
Estonia	24	Russia	147
Ethiopia	65	Senegal	3
Georgia	70	Slovakia	59
Ghana	32	South Africa	161
Guatemala	9	Sri Lanka	87
Hungary	62	Swaziland	29
India	63	Tunisia	42
Ivory Coast	70	Ukraine	92
Kazakhstan	36	Uruguay	53
Kenya	54	Vietnam	78
Laos	229	Zambia	145
Malawi	87	Zimbabwe	72

Highlights

- Socioeconomic variables should be taken into consideration in future research or when planning physical activity interventions in people with alcohol use problems.
- Interventions that seek to improve mobility among those with alcohol use problems might be an important strategy to increase physical activity.
- Differences in physical activity levels between rural and urban settings indicate that an urban environment in most low-to-middle income countries is not conducive to safe physical activity.